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South Dakota Farm and Home Research | SDSU Agricultural Experiment Station

Summer 1951

South Dakota Farm and Home Research

Agricultural Experiment Station

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SOUTH DAKOTA

FARM and HOME Research

Vol. II, No. 4 Summer 1951

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Dear Folks:

Neither the delayed season nor the rush of farm work kept you from coming in to view the results of the research work carried on by the Station at the recent Agronomy Field Day.

The interest which farmers and stockmen are taking in the progress and achievements of the research activities of their Experiment Station is an inspiration and a challenge to every one of us engaged in Station work. This interest from out over the state has recently manifested itself by the thousands of producers who have been in attendance at both the Livestock Feeders Day and the Agronomy Field Day.

In June South Dakota State College was host to 200 scientists from 14 cornbelt states and the United States Department of Agriculture. Interspersed with their discussions of soil and crop problems were field trips to different farms located in Brookings, Moody, Minnehaha, Beadle and Spink counties. It was truly a conference in which science and practice were observed under our South Dakota conditions. These scientists and their associates in other agricultural areas are the real molders of our agriculture. Through their efforts, new crops and improved varieties are developed to meet the rigors of climate, insect pests and diseases.

This issue completes the second year for the Quarterly. More farmers are requesting that their names be placed on its mailing list. This we are very happy to do, as we feel that this is one more way in which the Experiment Station can be of greater service to the state.

Sincerely,

L. B. Johnson

Director

SOUTH DAKOTA
FARM and HOME Research

A REPORT OF PROGRESS

Vol. II SUMMER, 1951 No. 4

In This Issue

Our Cover

Emery Bartle, one of our dairy husbandmen, says that chopped alfalfa is a good pasture supplement for summer-feeding dairy cattle when the weather gets warm and the pastures get short and dry.

A field cutter chopped the alfalfa into quarter-inch lengths after the field had been mowed and windrowed.

Your editor went out to get a picture of the haying operations, got a little too close on the windward side of the blower and came back with her hair full of chopped alfalfa. Maybe it's good for editors, too. Emery didn't say.

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What
SOUTH DAKOTA WOMEN EAT

By Lida M. Burrill and Beth Alsup

What and how much do South Dakota women eat? To help answer this question 57 Brookings women, ranging from 30 to 84 years of age, have, at some time during the past two and one-half years, carefully weighed and recorded every bit of food eaten during a 7-day period. This was done in the home of each woman so that food intake and other habits of living were interrupted as little as possible, with one exception. One morning during the week was spent in the Experiment Station Nutrition research laboratory, at which time basal metabolism and various chemical and physiological tests were made.

Various Age Groups, Economic and Social Levels Studied

The women chosen for this study represented various economic and social levels as well as different age groups, but all were physically able to carry on the normal household and community activities for their age. They were fairly evenly distributed in the various age groups with 9 from 30-39, 8 from 40-49, 14 from 50-59, 9 from 60-69, 10 from 70-79, and 7 over 80 years of age. The group included 2 unmarried women who lived with other people, 11 widows living alone, and 36 women who lived with their husbands, husbands and children, or just children. Only the two single women and two married women were employed outside of the home.

Careful Recording of Food Intake Necessary

Prior to the week during which the food intake record was made, each woman was carefully instructed in the techniques of weighing her diet on

A research assistant visits the home of one of the women on the first morning of a 7-day food weighing period. At this time she assists the woman in weighing and recording breakfast.

food scales which were supplied by the research laboratory. Then during the week when she was actually weighing her food, workers from the nutrition research laboratory called on her at least once a day to answer any questions she had on the weighing of the food or the keeping of accurate records.

Since the study was planned to secure a pattern of the woman's usual diet when it was completely self-selected, as few restrictions as possible were made on her activities which might influence her choice and consumption of food. For instance, even the between-meal snacks were recorded, although it was necessary in some instances to estimate the size of a serving, rather than to get its weight, when the woman was out for an afternoon club meeting or an evening of bridge.

The food intake records kept by the women have been carefully studied as to the consumption of certain food groups and also as to the amounts of each of the nutrients which the food supplied. In addition, the women have been grouped by age decades beginning at 30 years to show possible changes in food habits with age.

Recommended Dietary Plan

One recommended dietary plan for the adult woman includes the following foods or food groups daily:

2–3 cups milk
1 egg, (or at least 3 to 4 per week)
1 or more servings meat, fish, or poultry
1 or more servings potatoes
1 serving green or yellow vegetable
1 serving other vegetable
1 serving vitamin C-rich food
1 serving other fruit
3 or more servings whole grain or enriched cereals and breads
1 or more tablespoons butter or fortified margarine

Not Enough Milk in Diet

As a group, the dietaries of the Brookings women studied met this recommended dietary plan except in milk and green and yellow vegetables. Table 1 summarizes the average number of daily servings of the different food groups. The milk intake was consistently low for all six decades ranging from 0.5 to 0.9 cups per day. Two women had none at all and many others used just a small amount on cereal or in coffee. Moreover, only two of them averaged as much as the recommended two cups per day.

Table 1. Average Number of Daily Servings of Food (Summary for 57 Brookings Women Grouped by Decades)

	30-39	40-49	50-59	60-69	70-79	80-Up	Mean
Meat, fish, poultry	1.1	1.1	1.2	.9	.9	.7	1.0
Eggs (per week)	2.9	3.4	3.6	3.4	2.1	2.5	3.0
Milk (cups)	.7	.9	.5	.8	.6	.8	.7
Enriched cereal and bread	3.3	3.1	4.6	4.1	5.1	4.4	4.1
Refined cereal	.5	.8	.4	.4	.5	.5	.5
Vit. C-rich foods	1.0	1.4	1.1	1.1	.9	.8	1.0
Other fruit	.7	1.2	1.3	1.2	1.0	.8	1.0
G. and Y. vegetables	.2	.4	.2	.2	.2	.3	.2
Potatoes	.6	.8	.7	.7	.6	.6	.7
Other vegetables	1.0	1.4	1.0	.8	.6	.5	.9

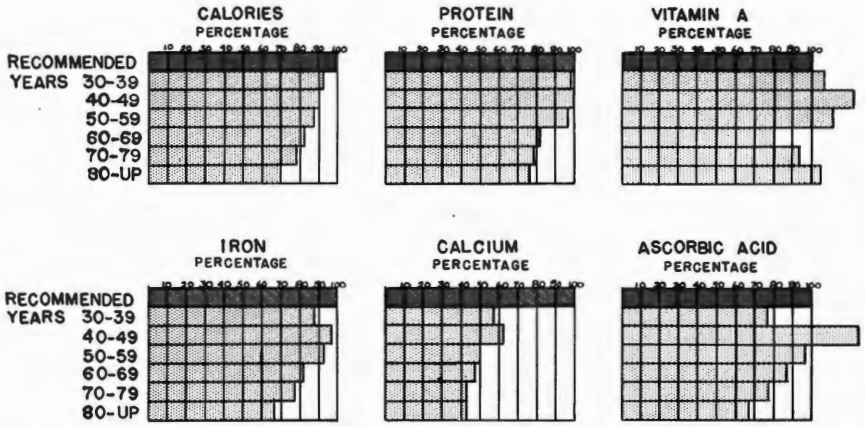


Fig. 1. Comparing the amount of nutrients consumed by Brookings women with the allowances recommended for adults by the Committee on Foods and Nutrition of National Research Council.

Diet Low in Green and Yellow Vegetables

There was very little difference between the individual decades in regard to consumption of green and yellow vegetables with none averaging more than one-fourth serving per day. The term green and yellow vegetables includes only those vegetables with at least 1000 I.U. (International Units) of vitamin A per 100 grams of food, such as asparagus, broccoli, chard, leaf lettuce, pumpkin, squash, turnip greens, beet greens, carrots, spinach, and sweet potatoes. Sixteen of the 57 women did not have a single serving of these vegetables during their 7-day weighing period; only nine had as much as one-half serving daily; and only two averaged the recommended one serving daily.

There seemed to be a definite trend for the women over 60 years to eat less meat, fish, or poultry. This downward trend was also observed in the consumption of eggs after 70 years of age. However, they tended to eat more enriched cereals in these later years.

Vitamin C Foods Adequate

The vitamin C-rich foods include the citrus fruits, tomatoes, strawberries, cantaloup, and raw cabbage. All of the age groups averaged close to the recommendations of one serving a day, with only seven individuals consuming less than one-half serving a day and twenty-nine consuming more than one.

Further Study of Caloric Requirements of Older Women Needed

The nutrients supplied by the dietaries have been calculated from food tables. In Figure 1, averages of the nutrients for each age group have been compared with allowances of nutrients recommended by the Committee on Foods and Nutrition of the National Research Council. However, since some extremely high individual records tended to cover up deficiencies in various groups, the percentage of individuals in each age group who consumed two-thirds or more of the recommended allowances were calculated. This information is shown in Figure 2.

A quick glance at Figures 1 and 2 reveals that with the possible exception of vitamin A the intake of all nutrients became gradually less with increasing decades after the age of 60. This appears to reflect the general tendency of older people to eat less as they become less active. It is also observed that the average caloric intake of each of the groups is below that recommended. However, there was no apparent evidence of widespread underweight or undernourishment among the women. These observations have lead to the conclusion that further study of the energy requirements and caloric allowances of older women is needed. There was a wide range in individual intakes from approximately 800 to 2500 calories daily, but the extreme values were comparatively few in number.

Protein Intake at Recommended Level

The average protein intake for the women from 30 to 59 years of age was approximately the same as the recommended allowance, with only two individuals consuming less than two-thirds of that amount. However, it showed a rather sharp decrease with the women over 60, which was not surprising when the lower consumption of meat and eggs of this age group is considered.

Since the amount of milk consumed was far below the recommended level in all age groups, it was to be expected that the calcium intake would be quite low, with very few subjects having an adequate amount. Iron, the other mineral studied, was consumed in smaller quantities by the women over 60, with over 40 percent of the 80 year-olds having less than two-thirds of the recommended allowance as shown in Figure 2. However, with the exception of two women, one in her forties and one in her seventies, the hemoglobin was in a normal range which usually indicates an adequate intake of iron.

The calculated vitamin A intake

Continued on page 75

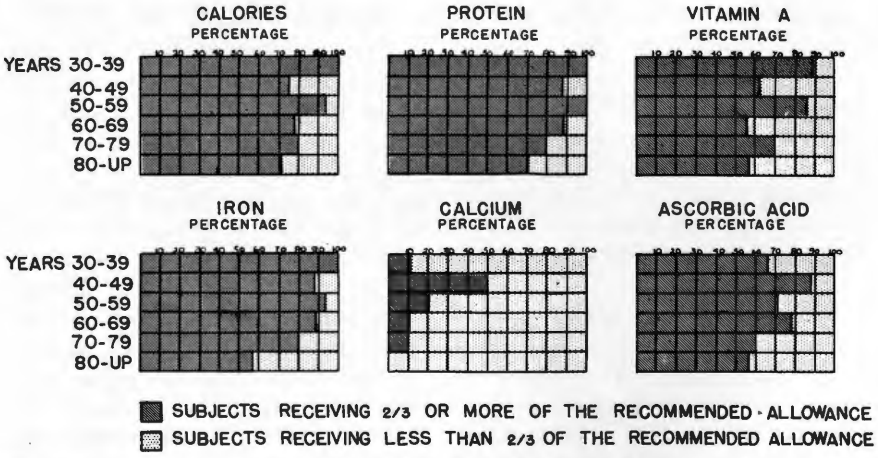


Fig. 2. Percentage of Brookings women in six age groups who consumed two-thirds or more of the dietary allowances of nutrients recommended for adults by the Committee on Foods and Nutrition.

This poultry house has a good, properly installed cedar shingle roof which will give satisfactory service to the owner over a number of years.

Roofs with less than one-quarter pitch such as on this one, should not use the cedar shingles. A good choice would be a built - up roofing, or asphalt shingles properly fastened.

KEEPING A *Roof* OVER YOUR HEAD

By Dennis L. Moe

A Dakota wind has just blown off a number of asphalt shingles on your barn. You glance over at your neighbor's barn to see what damage has taken place. Why, the entire roof is intact! You begin to wonder why. Surely, there was no difference in the wind velocity. His barn has no more windbreak than yours. The roof pitch is the same. Both of you purchased the shingles from the local dealer and applied them the same year. No, there must be some other reason.

Building Requirements Vary

Requirements of farm buildings vary with climate, topography of the land, and type of agriculture, all of which cut across state lines and therefore are regional in character. Some of the requirements are also of direct national and inter-regional significance. To obtain service and design information on farm buildings, studies of specific building materials are being made by the Agricultural Engineering department at the South Dakota State College Experiment Station in cooperation with the State Experiment Stations of the North Central Region on a regional project.

This field study on farm building materials in South Dakota involved

157 material inspections on 101 farm buildings, conducted on 62 different farms. The types of structures inspected were residence, movable poultry brooder house, central poultry house, central hog house, granary, general purpose barn, sheep barn, dairy barn, milk house, temporary corn crib, permanent corn crib, shop, implement storage house and garage. General purpose barns were observed more often than any other type of building. The building sizes also varied from a very small, movable building to very large barns of 100,000 cubic feet. Observations were conducted in both East and West River areas. Table 1 shows the materials inspected by areas.

Table 1. Data on Location and Items of Survey

Item	Area 1 (East of Missouri River)	Area 2 (West of Missouri River)
Foundations	33	18
Asphalt shingles	8	18
Roll roofing	1	16
Sheet metal	8	11
Wood shingle	23	21

Information was also gathered on each building such as: age of structure, foundation type, type of floor, type of wall, roof slope, windbreak present, roof type, drainage, subsoil type, present general condition, and estimated future life.

Types of Failures Found in Roll Roofing and Asphalt Shingles

Performance studies on roll roofing and asphalt shingles have been completed, and the studies on the other materials will be finished this coming year.

Failure as used in this study signifies some type of damage to the material but not necessarily a total failure. In a few cases it could be the natural deterioration with age of the material.

Table 2 shows the types of failures encountered where roll roofing was used. As could be expected, the tables show a greater total number of failures than there were materials inspected, as most materials had more than one type of failure and were therefore entered in several columns. For example: one roll roofing inspected may have failed by being torn and also may have leaked. Therefore, the failures for that one roofing would be entered as two failures.

Of the 17 inspections made on roll roofing, 13, or 76.5 percent, showed some failure had taken place. The main types of failures observed for the roll roofing were: breaks or tears, leaks, and wind damage.

Table 3 shows the types of failures observed on asphalt shingles. Of the 26 roofs inspected that were covered with asphalt shingles, failure of some

Table 2. Data on Roll Roofing Failures

Total inspected	Number of failures	Broken or torn	Blown off	Leaks	Loose roofing
17	13	11	10	11	1

Table 3. Data on Asphalt Shingle Failures

Total inspected	Failures	Curling	Broken or torn	Blown off	Leaks
26	8	5	3	4	4

kind was indicated on 8, giving a 30.8 percent failure.

Roof Failures Due to Method of Applying

From these facts gathered on asphalt shingles and roll roofing, it seems that the majority of failures can be traced to improper application of the material. The causes occurring most frequently were:

1. Not following the manufacturers' directions where application was made by an owner or tenant rather than by a carpenter or contractor.

2. Using the wrong kind of nails, glue, and fasteners, or not using a sufficient amount of each.

3. Poor condition of the material to which the roofing was fastened.

4. Lack of roofing accessories such as flashing, ridge strip, and starting strip.

For most farm building roofs in South Dakota, a wisely selected and properly applied asphalt shingle would very likely give more satisfactory service than a roll roofing. However, on certain temporary buildings a good roll roofing certainly has economical advantages. Practically all asphalt shingles, regardless of roof pitch, should be fastened down securely by gluing or with metal fasteners. (Project 203. Leader: Dennis L. Moe, Agricultural Engineering Dept.)

What South Dakota Women Eat

Continued from page 72

was higher than was anticipated from the small number of servings of green and yellow vegetables. This may be partially explained by two facts: (1) There were a number of individual dietaries which were very high in vitamin A; (2) The inclusion in the diet of liver which contains extremely large amounts of vitamin A.

The ascorbic acid intakes ranged from 9 to 134 mg. daily with most of them, however, falling in a medium range. The 40-49 year group appears to have an extremely high intake, since four out of the eight individuals consumed more than 100 mg. daily. The intakes that were relatively low in this nutrient appear to be reflected in the blood serum ascorbic acid values, although very few clinical symptoms of vitamin C deficiency were apparent. For this reason during the past year, further study of ascorbic acid intake plus excretion tests have been made.

Some of the same 57 Brookings women used in the first study served for this one also. The subjects again weighed and recorded their food for seven days, but, in addition, they saved a portion of this food which was then analyzed for ascorbic acid. Furthermore, because of the apparent need for further study of caloric intake, additional portions of all food consumed was saved for calorie determination. The results of this later work on the intake of ascorbic acid and energy value of food will be reported at some future date. (Project 178. Leaders: Lida Burrill and Beth Alsup, Home Economics Dept.; Alvin Moxon, Chemistry Dept.; in cooperation with other stations in the North Central Region and the Bureau of Human Nutrition and Home Economics, as a part of Project NC-5, "The Nutritional Status and Dietary Needs of Population Groups in the North Central Region.")

Fig. 1. Root rot losses are very severe in some fields. The grain in the foreground was grown on natural field soil, that in the background on soil which had been treated to kill the disease-producing organisms. Killing the soil fungi eliminated the root rot damage to the crop. Note increased size and heading of the barley when root rot was eliminated. Barley in this experiment yielded around 15 bushels per acre on untreated soil and about 50 bushels on the treated soil under field conditions.

Root Rot IN CEREALS AND

Plant Pathologists a Step Nearer in Search for Control

G. W. Bruehl

Root rot diseases of cereal crops and grasses have become a subject of much concern to farmers in South Dakota. This group of diseases exacts a heavy toll in agricultural production. It can be reasonably estimated that many farmers lose 15 to 20 percent of their crop and many lose more because of root and crown rot diseases (Fig. 1).

These diseases are as yet largely uncontrolled. They have been the subject of extensive investigation, both in this country and others, particularly Canada. In spite of disappointing results from the standpoint of practical control, research is being conducted to further unravel their complexities in the hope that ultimately a practical control measure will be discovered.

Control of a crop disease is occasionally accomplished through a single discovery, such as the finding of wilt resistance in the case of flax. On the other hand, successful control measures are usually discovered only after extensive experimentation during which knowledge of the disease is expanded in all directions. An important part of this information is to learn what organism causes the disease and then how to produce the disease readily under controlled laboratory and

greenhouse conditions. Some diseases are dependent upon special soil and weather conditions for their development. Such conditions may occur in one place one year and somewhere else the next. The ability to produce the disease experimentally in the greenhouse frees the experimenter from this dependence upon fluctuating soil and weather conditions. This acts to speed the work and increase its accuracy.

One of these root rots (Pythium root rot) was produced in the greenhouse this past winter (Fig. 2). This is just one of the many root rot diseases. This discovery will help to make real progress in understanding this disease.

Symptoms on Roots

Symptoms are the reactions of the plant to disease; the visible signs of disease which tell us that something is wrong. The disease is most readily observed on large, actively growing wheat roots. Each infection forms a lesion, or area of rotting tissues. Healthy wheat roots are glistening white and plump when the soil is carefully washed away. The light tan to brown lesions of this disease contrast with the healthy tissues (Fig. 3A) and are rather easy to observe.

The most common damage to the root system of small grain crops in South Dakota is mainly a destruction of the fine roots (Fig. 4). These rootlets are so delicate they can seldom be removed from the soil, so this part of the disease may go largely unobserved. These delicate roots are most important to the plant as they absorb water and plant food from the soil and constitute an important part of the total root system. Pythium root rot may practically eliminate this fine root system.

Symptoms Above Ground

These injuries to the root system are also reflected in the above ground parts of the plant. The symptoms are generally not evident above ground until the plants are three or four weeks old, or older. From this age on they are visibly stunted; the leaves are narrower than normal and generally lighter in color. The lower leaves may turn yellow and die with no apparent cause. Development of the crowns and stools is greatly reduced, severely dis-

Fig. 2. Effect of Pythium root rot on growth of barley, healthy plants in left pot and diseased plants on the right. A pure culture of the fungus was placed in the pot on right at planting time. Both pots received same amount of plant food and water. Shortened straw, small heads and lack of tillers in right pot are due to damage caused by the fungus to the root system.

eased plants having only a single stem with no stools (Fig. 2). The straw is shortened, particularly in some very susceptible barley varieties. Grain fields vary from single small heads per plant to plants with numerous stools and nearly normal heads, depending upon the severity of the attack. Plants with diseased roots may suffer from drought sooner than those with healthy roots because much of the root system has been injured or killed.

This disease delays maturity. It generally does not attack uniformly but varies with local soil conditions so that grain may be ripe in one spot and still quite green close by. This lack of vigor, shortage of stools, delayed and uneven maturity give reason to suspect presence of Pythium root rot.

Above ground symptoms cannot be taken as proof of the presence of root rot. Soil conditions, such as nutrient deficiencies and salt accumulations, may cause similar injuries. In the final analysis a real diagnosis depends upon careful field and laboratory examination of the roots.

Weather in Relation to Disease Development

Weather influences disease development by acting on both the fungus and the crop. This pathogen grows less quickly in cold soil, whereas wheat and barley can grow very well under cool soil conditions and consequently the crop may become quite well established before the fungus becomes active in the spring. As the soil gradually warms, the fungus grows more rapidly and should other soil conditions favor this root rot, disease development will be well underway before a good crown with tillers can be formed.

Soil moisture, like temperature plays a part. High moisture levels favor the spread of the fungus from root to root. The fungus needs only a day or two with free water in the soil to produce swimming spores, and make a new infection. Once inside the root, dry weather can return without stopping the growth of the fungus already within the root because the root is filled with water. Each wet period may bring a new spread of the fungus. When the Pythium population is high and many roots are invaded and destroyed, the onset of dry weather and high temperatures is particularly damaging. (Project 115. Leaders: G. W. Bruehl and C. M. Nagel, Plant Pathology Department, in cooperation with the USDA.)

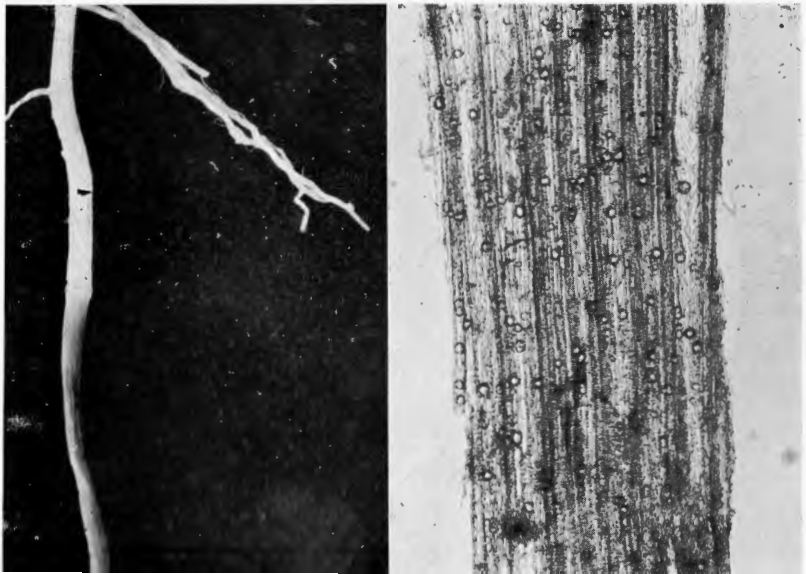


Fig. 3. Most easily observed of field symptoms on wheat is the presence of brown lesions (A) on otherwise large white healthy root. Fungus has invaded the brown region, killing the cells. Viewed under a microscope (B) many round, thick-walled resting spores are seen in diseased root.

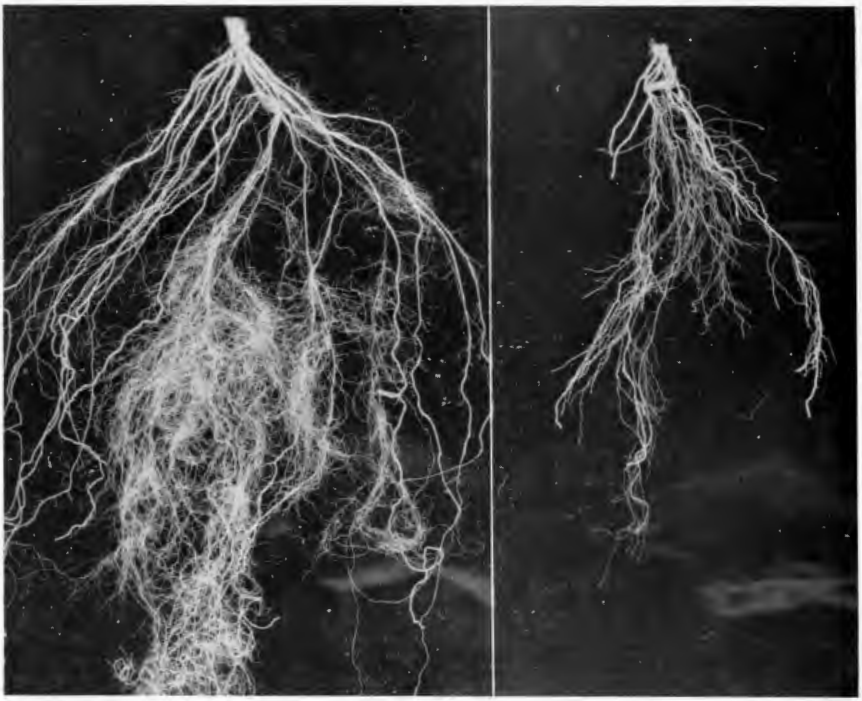
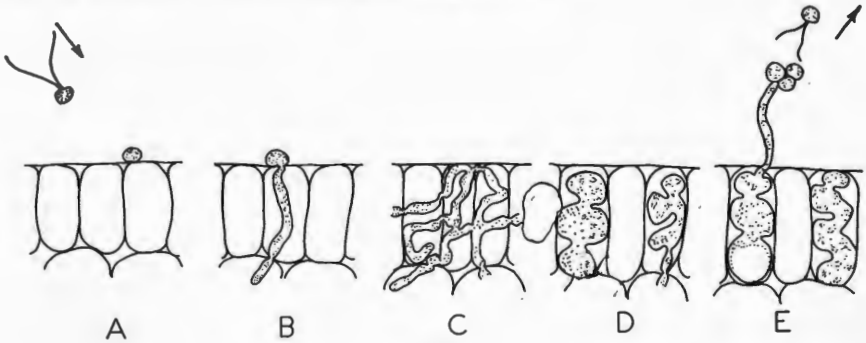
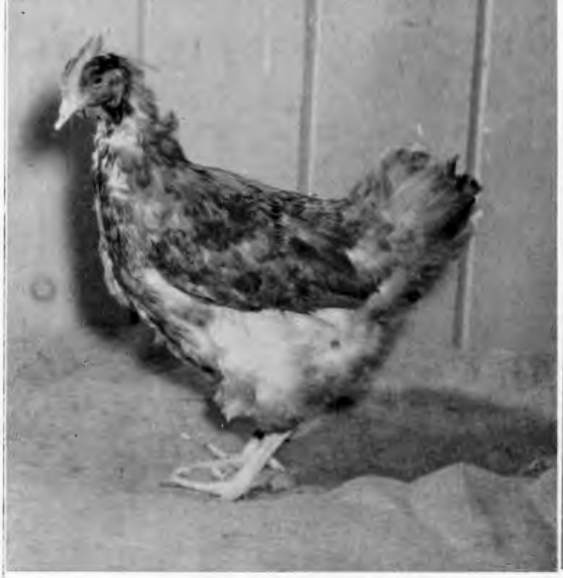
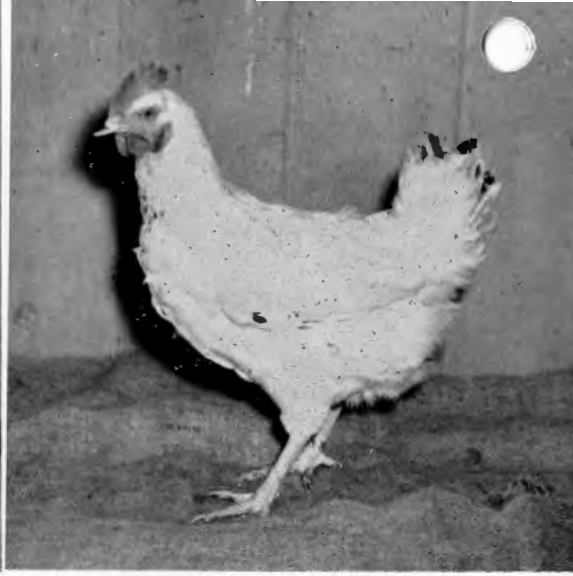


Fig. 4. One of the most serious effects of this disease is the destruction of the fine root system. Compare the roots of a healthy barley plant (left) with those of a diseased plant (right). Both are of the same variety, age, and each received the same amount of plant food and water. It becomes obvious that such damage to the root system seriously reduces the yielding capacity.

Fig. 5. Illustrating stages which the fungus goes through to infect a healthy root. At (A) is seen a swimming spore which has come to rest upon the surface of a root. Germination of the spore takes place and it passes into the thread stage (B). Once inside the cells of the root, the fungus grows rapidly and develops an extensive system of threads (C) which take food from the root. After a short time, some of the threads enlarge into irregular masses called sporangia (D) which function in forming a new crop of spores (E). The sporangium puts forth a tube so that the tiny spores can enter the soil moisture where they swim off to infect more roots.







Topcross pullets. Both types of plumage shown here occurred in the topcrosses.

COMBINING ABILITY OF INBRED

D. G. Jones and Wm. Kohlmeyer

Development of inbred lines of poultry for the production of hybrid chickens is accompanied by many problems. One of these problems is the matter of evaluating the inbred lines in their early stages of development as to their probable future value.

One method of approach to this problem of testing inbred lines involves the use of the topcross. A topcross is a mating of inbred males with random bred females. It may be and usually is a cross between breeds, but it can be made within one breed. From such a cross the breeder hopes to be able to tell whether the inbred under test has good combining ability. If combining ability or "nicking" results from such a cross, it is generally felt that such an inbred may combine well with other inbred lines to form desirable hybrids. Topcrossing has been the method of approach for evaluating inbred lines of poultry at the South Dakota Agricultural Experiment Station.

White Plymouth Rock Inbred Lines Tested

To obtain information on the combining ability of inbred White Plymouth Rock lines maintained at the Experiment Station in Brookings, New Hampshire females were mated to inbred White Plymouth Rock males. Two pens of pullets from this topcross were housed at the North Central Station at Eureka. In addition, two pens of New Hampshire pullets served as controls. Most of the topcross pullets were sired by males of two of the inbred lines of White Plymouth Rocks, although a few pullets were sired by males of two other lines. These pens were compared with

Reciprocal cross pullets. Two types of plumage which occurred in the reciprocal crosses.

LINES OF *Poultry . . .*

respect to egg production, mortality, broodiness, and egg size during a 10-month period beginning November 1, 1949.

The experiment is being repeated with another and somewhat larger group of pullets this year with the following modifications: The topcross pullets this year were the offspring of a single inbred line of White Plymouth Rocks mated to New Hampshire females and were placed in one pen. The reciprocal of this cross (New Hampshire males mated to inbred White Plymouth Rock females of the four inbred White Plymouth Rock lines) was also made. These were housed in another pen. For controls, one pen of New Hampshire pullets, and one pen of White Plymouth Rock pullets were housed. The latter were of the same strain as that used to develop the inbred White Plymouth Rock lines. Each year the pullets used in these trials were hatched at the same time and were brooded and grown together at the Experiment Station at Brookings. At housing time they were trucked to the North Central substation at Eureka. The experimental period for the second group began October 1, 1950 and is still continuing. The same data are being obtained on this group as was obtained on the previous group.

The laying house at the North Central substation is of rammed earth construction and the birds are kept in confinement except for access to a wire-floored sunporch when the weather is suitable. All pens receive a free-choice grain and mash laying ration with water and oyster shells. The management so far as possible has been the same as that received by well-fed, well-cared for South Dakota farm

Table 1. Performance of Topcrosses and New Hampshires, Eureka, 1949–50

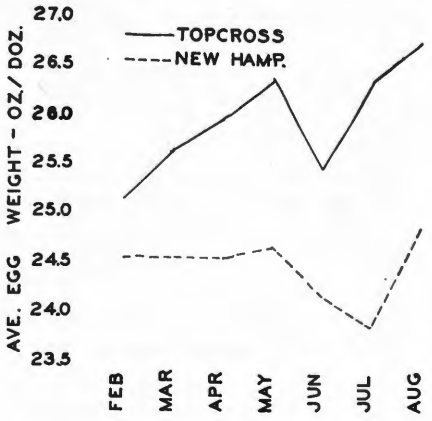
Month	TOPCROSSES		NEW HAMPSHIRES	
	Prod.	Percent Mortality (cumulative)	Prod.	Percent Mortality (cumulative)
November	35.1	1.52	31.3	1.52
December	57.1	4.54	59.6	1.52
January	57.2	12.12	56.7	1.52
February	64.9	18.18	62.1	3.03
March	63.9	19.70	65.6	3.03
April	55.1	22.73	64.6	4.54
May	46.7	27.27	55.1	7.58
June	48.4	33.33	41.9	10.61
July	47.4	34.85	44.2	12.12
August	37.1	37.88	36.4	15.15
Totals	**51.53***	**37.88**	**51.97***	**15.15**

*Weighted average

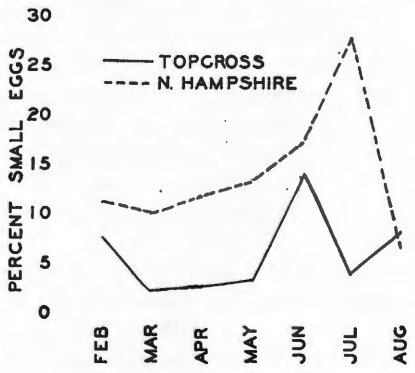
flocks. Daily records are kept of egg production and mortality for each pen. To adjust for differences in the time and amount of mortality in the various pens, percentage egg production is calculated on a hen-day basis. The mortality experienced as well as the time the mortality occurs is a very important factor in determining profits or losses in the poultry enterprise.

Broodiness and Mortality Affect Topcrosses First Year

Data covering the first experimental group of pullets are presented in Tables 1 and 2 and Graphs 1 and 2. It will be noted from Table 1 that there was very little difference in percentage egg production between the topcrosses and controls for the entire experimental period. There were slight seasonal variations between the two groups as to percentage egg production during the year. The topcross birds experienced a heavier mortality, and this occurred earlier in the experimental period. This, of course, had a very drastic effect on the total number of eggs produced by the topcross pens.



Graph 1. Average egg size of topcrosses and New Hampshires. Eureka Substation, 1949–50.



Graph 2. Percent of small eggs produced by topcrosses and New Hampshires. Eureka, 1949–50.

Table 2. Egg Weight, Percent Small Eggs, and Broodiness in Topcross and New Hampshire Pullets, Eureka, 1949–50

Month	TOPCROSSES			NEW HAMPSHIRES		
	Av. Egg Wt. oz./doz.	Percent Small Eggs*	No. Broody Periods	Av. Egg Wt. oz./doz.	Percent Small Eggs*	No. Broody Periods
December	.....	....	1	.....	.....	0
January	.. ..	....	6	.....	.....	0
February	25.2	8.3	4	24.6	11.9	0
March	25.7	2.9	6	24.6	10.8	1
April	26.0	3.4	6	24.6	12.4	5
May	26.4	3.8	3	24.7	13.9	1
June	25.5	14.5	5	24.2	17.9	4
July	26.4	4.6	6	23.9	28.4	8
August	26.8	8.9	0	24.9	7.3	1
Total	**25.9†**	**6.2†**	**37**	**24.5†**	**14.3†**	**20**

*Eggs weighing less than 23 oz. per doz.
†Weighted average.

Table 3. Egg Weight and Percent of Small Eggs, Eureka, 1950–51

Month	Average Egg Wt., Oz./Doz.				Percentage of Small Eggs*			
	N.H.†	W.P.R.	Topcross	Rec. Cross	N.H.	W.P.R.	Topcross	Rec. Cross
January	24.0	24.8	26.3	25.4	23.8	13.1	0.0	11.0
February	24.7	25.4	27.1	26.3	18.3	11.4	0.9	5.6
March	25.0	26.2	27.9	26.5	7.0	11.4	0.9	5.7
April	24.6	26.2	28.2	26.7	18.1	5.6	0.0	4.0
May	25.1	27.0	28.3	26.6	5.8	4.7	0.0	7.5

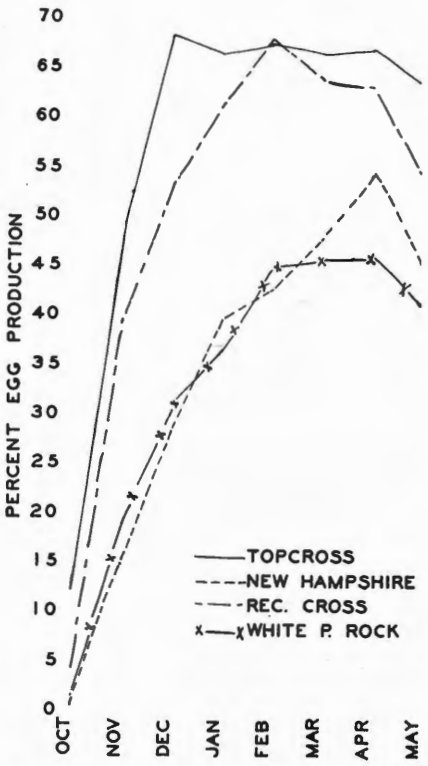
*Eggs weighing less than 23 ounces per dozen.
†N.H.—New Hampshire; W.P.R.—White Plymouth Rock; Topcross—Inbred W. P. Rock males x New Hampshire females; Rec. Cross—New Hampshire males x Inbred W. P. Rock females.

When calculated on a per-pullet housed basis, the average egg production of the topcrosses was 23 eggs per bird less than that of the New Hampshires. Not all of this difference was due to the differential mortality in the two groups, however.

Inspection of Table 2 reveals that the topcross birds experienced more broody periods which would also cut down on total egg production, and hence the average eggs produced per pullet housed. The broody periods also affect percentage of egg production, and it seems likely that had there been less broodiness and less mortality, the topcrosses would have had a higher percentage production for the year than the New Hampshires. In other words, the rate of lay of the topcrosses in laying condition probably exceeded that of the New Hampshires. It should be pointed out that no culling was done at any time; any sick birds remained in the flock until death occurred. By culling it would have been possible to raise the percentage production level, but this would have tended to eliminate the effect of differences between the two groups in morbidity and mortality.

Topcrosses Lay Larger Eggs

In one respect the topcross birds were superior to the New Hampshires. Data presented in Table 2 and Graphs 1 and 2 show that the topcrosses not only laid larger eggs on the average, but that they also laid fewer small eggs (eggs weighing less than 23 ounces per dozen).



Graph 3. Showing the percentage egg production of crosses and pure breeds. Eureka, 1950-51.

Topcross Superior in This Year's Test

Production data for the present year are presented in Graph 3. The superiority of the topcross and the reciprocal of this cross is clearly evident. Not only did these two pens reach a high level of production in a shorter interval, but they also attained and have maintained a higher rate of production up to June 1. Mortality for all groups has been low to the present time so there are no significant differences between pens. As in the previous year, the topcross eggs have a greater average weight, and there is also a smaller percentage of small eggs laid by this pen. The reciprocal of the topcross also shows this same advantage. Data on average egg size and percentage of small eggs are shown in Table 3. Broodiness has been a much more serious problem in the White Plymouth Rock pen than in any of the others to the present time.

The superiority of the topcross and the reciprocal cross in this year's test is plain, but the reasons for this superiority are not clearly evident at this time. The fact that neither broodiness nor mortality has been serious this year probably accounts for some of this pronounced superiority of the crosses over the pure breeds, but it seems unlikely that it can account for all of it. As mentioned previously, the heavy mortality and high incidence of broodiness in the topcrosses in the first year's test undoubtedly reduced the percentage of lay of the topcrosses. Another factor contributing to the superiority of the crosses is the failure of the pure breeds to achieve the level of performance attained the previous year. Presumably most of this difference is environmental.

Regardless of the cause of the superiority of the crosses, if these results can be repeated consistently, it may give the poultry breeder an entirely new concept with respect to the use of inbred lines. If topcrossing will consistently produce results such as these shown in the second year of this test, chickens of superior egg laying ability could probably be produced much more economically this way than they could by crossing four inbred lines, which is an accepted method of producing hybrid chicks. Whether the topcross is called a hybrid or a crossbred is immaterial so long as the desired results are produced. (Project 194. Leaders: Dean G. Jones and Wm. Kohlmeyer, Poultry Department; Albert Dittman, Eureka Substation.)

Marketing

Slaughter Lambs

BY CARCASS WEIGHT AND GRADE

By Ottar Nervik and David G. Paterson

In marketing livestock, farmers and ranchers are interested in removing as much of the guess work as possible in determining prices. Slaughter livestock can be sold in three different ways: (1) by head, (2) per hundred pound live weight, and (3) per hundred pound carcass weight.

The first method, though formerly widely used, is no longer in common use for slaughter livestock. This method of sale seems to be very simple, but is really the most difficult method for both seller and buyer. It makes it necessary to estimate both the live weight and dressing percentage (yield) of the animal. In addition an estimate has to be made of the grade of the carcass.

The second method of selling, by hundred pound live weight, is the common system in this country. This removes part of the guess work because the live weights are determined by scales. Buyers and sellers still have to estimate the dressing percentage and grade of the carcass.

In the third method, prices are based on the weight and grade of the carcass. Since the value of the animal is determined by the pounds of meat and by-product it produces, this system will be more similar to methods used in determining wholesale prices. In this method the carcasses are weighed and graded and prices are based on the basis of these factors. Thus this system removes still more of the guess work in selling.

Since sale by carcass grade and weight removes more of the guess work than the present system, it is only natural to ask: Why is livestock not sold on this basis? Any new method of marketing requires considerable

change in packing house procedure. Such changes may be expensive, and are not justified unless the advantages of the new method are substantial.

Considerable research is needed to determine whether the new method is more satisfactory than the present method under practical packing house conditions. The North Central Livestock Marketing Committee in 1947 undertook a regional project entitled, "Marketing Slaughter Livestock by Carcass Grade and Weight." This project includes work on cattle, veal calves, hogs, sheep and lambs. As a part of this project, the South Dakota Station has been doing work on the desirability and practicability of marketing lambs by carcass grade and weight.

The first problem which has to be examined is whether the present method of selling by live weight does an adequate job in reflecting to the sellers the actual value of the lamb carcasses. In order to answer this question it is necessary to determine how accurately the lamb buyer can estimate the dressing percentage and the carcass grade from live animals.

If prices are to be determined by carcass grade and weight, it is of great importance that these factors, as far as possible, be determined in an objective manner; in other words, that they are the same even if different graders are employed. This is no problem as far as carcass weights are concerned, since these are established by scales. Grading, on the other hand, is based on subjective factors; consequently, graders in different packing plants may differ in their evaluations of these factors.

In the South Dakota project, data were collected on 32 lots comprising 487 lambs, most of these being selected from direct shipments. Live animals were graded by a packer buyer and an Experiment Station grader. Each grade was divided into three subgrades and assigned numerical values which were used in calculating the average grade for the lots. For example, 13 for "choice plus," 12 for "choice," and 11 for "choice minus" (Table 1).

Table 1. Numerical Equivalents of Grades

Live grades	Carcass grades	Number
Prime	Prime	14
Choice, plus	Choice, plus	13
Choice	Choice	12
Choice, minus	Choice, minus	11
Good, plus	Good, plus	10
Good	Good	9
Good, minus	Good, minus	8
Medium, plus	Commercial, plus	7
Medium	Commercial	6
Medium, minus	Commercial, minus	5
Plain, plus	Utility, plus	4
Plain	Utility	3
Plain, minus	Utility, minus	2
Cull	Cull	1

Individual yields were estimated by the Station grader on all lots and by the packer buyer the first six lots; but it was felt that this was so impractical that on the remainder of the lots the packer buyer only made estimates of the yield of the entire lot.

Carcasses were graded by a Federal grader, a packer grader, and a meat specialist from the Station. These grades were also divided into three subgrades.

How Accurate Are Buyer's Estimates on Yield?

The first problem analyzed was how accurately the buyer could estimate the dressing percentages for lots of live lambs. When the buyer's estimates were compared to the actual yield, it was found that he estimated

yields within 1 percent for 12 lots, within 2 percent in 17 lots, within 3 percent for 20 lots and within 4 percent in 27 lots. For three lots the buyer did not make any estimate of lot yields; these three were therefore excluded in this comparison. The buyer overestimated the yield in 19 lots and underestimated for 8 lots (Table 2).

Table 2. Buyer's Estimate of Dressing Percentage Compared to Actual Dressing Percentage for Lots

Difference between buyer's estimate and actual dressing percentage Percent	Number of lots
0—1	12
1—2	6
2—3	2
3—4	5
4—5	2

There was a tendency for the buyer to underestimate lots where the actual yield was over 48 percent, and to overestimate lots where the yield was less than 48 percent.

Of 15 lots yielding more than 48 percent, the buyer underestimated in 8 and overestimated in 7; of the remaining 12 lots which had yields of less than 48 percent, the yields were all overestimated. For a very large number of lambs, the buyer's estimates of yield would probably be closer to actual yields than it was in individual lots. Thus the average yield for all lots combined was 48.4 percent, the average of the buyer's estimates was 48.1 percent, an error of 0.3 percent which is relatively small. For individual lots, however, the errors ranged from 0 to 4 percent. Thus some farmers might not receive payment according to the dressing percentage of their lambs. For farmers as a group, however, the returns would be approximately the same whether live weight or carcass weight had been used (Table 3).

Table 3. Difference Between Buyer's Estimate of Yield and Actual Yields

Lots Yielding Over 48 Percent		Lots Yielding Less Than 48 Percent	
Actual yield	Buyer's estimate as deviation from actual yield	Actual yield	Buyer's estimate as deviation from actual yield
53.6	—4.1	47.1	+1.9
51.5	—4.0	47.0	+3.5
51.4	—3.9	46.9	+ .2
50.7	+ .3	46.6	+1.4
50.4	— .2	46.4	+ .35
50.3	+ .2	46.4	+1.6
50.2	— .2	46.1	+1.8
49.7	— .2	45.6	+ .4
49.6	—3.1	43.5	+ .5
49.2	— .95	42.7	+3.3
48.7	+ .8	41.4	+3.6
48.4	+2.1	40.1	+1.4
48.3	+ .2		
48.2	+2.5		
48.0	+1.5		

Buyer's Live Grades Correspond Closely to Carcass Grades

Individual grading of live lambs was made for 438 lambs. The buyer's live grade corresponded to the Federal carcass grade for 20.5 percent of the lambs. He overestimated by one-third of a grade for 19.6 percent and underestimated by one-third of a grade for 13.7 percent. In all, 53.8 percent of the estimates were accurate within one-third of the actual carcass grade. Eighteen percent were overestimated by two-thirds of a grade, and 6.4 percent underestimated to the same extent. Thus 78.4 percent were estimated within two-thirds of the actual carcass grade. This indicates that the buyer's live grades corresponded closely to the carcass grades (Table 4).

Although the buyer was close to the actual carcass grades in the majority of cases, there was a tendency to undergrade lambs which graded choice

Table 4. Buyer's Estimate of Carcass Grade from Live Lambs Compared To Actual Carcass Grades by Federal Grader

Deviation from federal carcass grades by ⅓ of grade	Number of lambs	Percentage of lambs
+6	9	2.1
+5	4	.9
+4	23	5.3
+3	39	8.9
+2	79	18.0
+1	86	19.6
0	90	20.5
—1	60	13.7
—2	28	6.4
—3	17	3.9
—4	3	.7
Total	438	100.0

and to overgrade lambs grading good or lower (Table 5).

These data reveal a tendency to overgrade lambs of below average quality and to undergrade better quality lambs.

Graders Show Little Variation in Judgment of Carcass Grades

If payments were to be made on the basis of carcass grade and weight, grades would have to be standardized in such a manner that different graders would not differ greatly in their judgment of the grade factors. In order to determine how close various graders come in their judgment of carcass grades, a comparison was made between grades by a Federal grader and a packer grader on 454 lambs. The two graders agreed on grades for 35.9 percent of the lambs, and were within one-third of a grade in 45.2 percent of the lambs. In another 19.3 percent their grades differed by no more than two-thirds of a grade. This would indicate that carcass grades by individual graders vary by relatively small amounts (Table 6).

Table 6. Carcass Grades by Packer Grader Compared to Carcass Grades by Federal Grader

Deviation from federal grades by ⅓ of a grade	Number of lambs	Percentage of lambs
+4	3	.7
+3	9	2.0
+2	61	13.4
+1	133	29.3
0	163	35.9
—1	72	15.9
—2	11	2.4
—3	2	.4
—4	0	0.0
Total	454	100.0

A Number of Problems Still To Be Studied

Results from this study show that estimates of carcass grades and weights from live animals are not accurate. Errors in estimates of yield are greater in magnitude than errors in estimates of grades. Of special importance is the fact brought out by the study that grades for better quality and yields for high yielding lambs tend to be underestimated, whereas the grades on lower quality and the yields on low yielding animals tend to be overestimated. Thus buying lambs

Continued on page 90

Table 5. Percentage of Buyer's Live Grade Which was Higher, Equal or Lower Than Federal Carcass Grade for Each Grade Group

Carcass Grade	Higher	Equal	Lower	Total
Choice	31.5	28.7	39.8	100
Good	51.4	19.2	29.4	100
Commercial	71.2	17.1	11.7	100
Utility	87.5	9.4	3.1	100
Cull	71.4	28.6	.....	100

Irrigated Pastures

SHOW SUBSTANTIAL GAINS OVER NON-IRRIGATED

By J. L. Leibel, W. W. Worzella. and E. Moncur

Successful irrigation projects have about one-third of the acreage of cropland in grasses and legumes. Because considerable irrigation is contemplated in the James River Valley of South Dakota as a part of the Missouri River Basin development, pasture experiments were undertaken at the Huron Development farm in cooperation with the Bureau of Reclamation.

The investigations have been carried on for three years, with new pastures added each year, to determine what may be expected in beef cattle gains per acre on irrigated pastures. Results have been very similar on the pastures used more than one year.

Beef Gains High on Irrigated Alfalfa-Brome Pasture

Grazing yearling beef steers on irrigated alfalfa and brome pasture under central South Dakota conditions resulted in 354.4 pounds of beef per acre for a 120-day grazing period, while adjoining native dry-land pasture produced 99.2 pounds of beef per acre. The returns per acre, after deducting extra labor costs for irrigation, fertilizer and seed, were $77.04 for the irrigated pasture and $25.79 for the native dry-land pasture (Table 1).

An irrigated pasture mixture produced a slightly higher gain per acre than did the irrigated alfalfa and brome (Table 1), but the increase was not large enough to offset the cost of the extra fertilizer applied. Extra fertilizer in the form of nitrogen was applied to the pasture mixture because most of the legumes had winterkilled. Results on fertilizing native pasture with nitrogen indicate some increase in hay yields, but no increase in gains of beef per acre.

Five Pastures Set Up

The five pastures used in the 1951 investigation were: Pasture I, a native pasture, non-irrigated, made up largely of western wheatgrass and blue grama with about 10 percent little blue stem, feather bunchgrass, and weeds; Pasture II, native pasture, non-irrigated, with similar vegetation as in Pasture I, but fertilized with 100 pounds of ammonium nitrate per acre in April; Pasture III, the grass mixture pasture was fertilized with 150 pounds of 0-43-0[1] and 250 pounds of 33-0-0 and irrigated. Pasture IV was irrigated alfalfa and brome established in the spring of 1947. It was fertilized with 250 pounds of 0-43-0 per acre. Pasture V, the dry-land alfalfa and brome pasture, received 100 pounds of 0-43-0 per acre.

Yearling Hereford Steers Used

High grade yearling Hereford steers, weighing approximately 498 pounds at the beginning of the experiment, were wintered to gain about one pound per head daily. At the start of the experiment, the cattle were divided into five lots to equalize for any differences in weight and quality.

Cattle were placed on pasture June 6, 1950 and removed on October 4, ex-

[1]Nitrogen—phosphorus—potassium

cept those on the alfalfa-brome, non-irrigated pastures, which were removed September 6 because all the vegetative growth was utilized. (Project 164. Leaders: J. L. Leibel and Wm. C. McCone, Animal Husbandry; W. W. Worzella, Agronomy, and E. Moncur, Bureau of Reclamation.)

Table 1. Production Data of Irrigated and Non-Irrigated Grass Land Harvested as Beef and Hay. Huron Development Farm 1950

Pasture	I Non-irrigated native pasture	II Non-irrigated native pasture, fertilized	III Irrigated pasture mixture	IV Irrigated alfalfa-brome	V Non-irrigated alfalfa-brome
Number animals/lot	5	5	11	14	4
Acres in pasture	13.0	13.1	6.24	8.48	3.1
Acres per animal	2.60	2.62	.57	.60	.77
Days on pasture	120	120	120	120	92
Average initial weight, lbs.	520.0	556.8	490.2	498.0	526.5
Average final weight, lbs.	778	797.4	703.9	712.6	731.5
Total gain/acre	99.2	91.8	376.8	354.4	264.5
Hay Production Data					
Yields per acre (tons)	.47	.56	2.66	3.09	1.36
Current Grass Treatment Production Costs*					
Seed/acre	$0.00	$0.00	$3.50	$3.10	$2.20
Fertilizer/acre	0.00	4.00	15.10	8.50	3.40
Irrigation and extra labor cost/acre	0.00	0.00	3.50	3.50	0.00
Return per acre after deducting current production cost, but exclusive of rental, interest on investment, risk, and labor for harvesting hay, and caring for cattle.†					
Beef Cattle	$25.79	$19.87	$75.87	$77.04	$63.17
Hay	7.05	4.40	47.80	55.62	24.26

*These cost figures were furnished by the Bureau of Reclamation.
†Native hay, $15; tame hay, $18; cattle at $26 per 100 pounds, fertilizer and seed at current cost.

Marketing Slaughter Lambs

Continued from page 88

on live basis does not adequately reflect their values.

Examination of carcass grading by various graders shows that in the majority of cases grades were within two-thirds of a full grade. Although the results are not conclusive, they indicate that carcass grades by well-trained graders will correspond closely.

Adoption of the carcass grade and weight method of selling livestock cannot be made before it is determined whether this system is practically feasible, taking into consideration present working procedure in packing plants. A number of problems have to be studied in order to give a definite answer to this question. Among the more important of these are: (1) a satisfactory method of identification, (2) the effect on slaughtering costs, (3) the method of adjusting for differences in by-product values, and (4) the extent of tissue shrinkage, both where animals are shipped from the market to a distant packing plant and where animals are held over in the packers' yards for some time before slaughter. These problems are now being studied under the South Dakota project. (Project 156. Leaders: O. Nervik, Agricultural Economics, and Ellis A. Pierce, An. Hus. Dept.)

SELENIUM RESEARCH FIELD *Expanding*

By Harlan L. Klug

Since 1933, selenium has been known to be the cause of "alkali disease," a disease which affects farm animals, both acutely and chronically, in certain grazing areas of western United States. However, the way in which selenium causes the death or distress of the animal is not known. Since several localities in western South Dakota are involved in this problem and since much of the early experimental work was done by the South Dakota Experiment Station Chemistry department, work has been continued on this problem to determine the chemical changes of selenium poisoning.

That this problem is not of local interest alone is witnessed by the fact that many requests are received for reprints of publications on selenium. The use of selenium compounds in the manufacture of television receivers has brought forth requests for information concerning the toxic action of selenium. In fact, this work has its implication in situations where selenium products are being handled by workers, where seleniferous foods are being ingested regularly, or whenever selenium comes in contact with living tissues.

Selenium Poisons Body Enzymes

Major emphasis on the research has been placed on proving a theory of enzyme poisoning by selenium, and its alleviation by arsenic, probably by the provision of an alternate pathway around the poisoned enzyme. Since interference with carbohydrate metabolism by selenium has been indicated, enzymes concerned with the body's breakdown of the sugars have been investigated. The activity of certain enzymes was found to be inhibited while other enzymes were not affected. Enzymes, not directly involved in sugar breakdown, reacted similarly. However, the selenium blood levels of the poisoned animals indicate that there must be enzymes approximately 25 times more sensitive than the most selenium-sensitive enzyme found to date.

It was also found that certain enzymes of the brain and lung were more sensitive to selenium poisoning than those of the liver or kidney. Although liver damage is common in selenium poisoning, this finding indicates that other organs should also be investigated.

Detailed study with one enzyme system showed that the selenium was uniting very firmly with one part of the system. Since the activity of this enzyme depends on the presence of a particular chemical group, known as a sulfhydryl group, it was thought that selenium might be poisonous because it was uniting with important sulfhydryls in the body. It was found however, that sulfhydryl reagents did not protect or reverse the system against selenium, that sulfhydryl analyses of inhibited systems did not show a complete loss of this group, and that some sulfhydryl-bearing enzymes were not inhibited by selenium. This apparently eliminates the selenium-sulfhydryl idea of inhibition and focuses attention on discovering the

more selenium-sensitive enzymes that are necessary for the body processes. Although the arsenic alleviation of selenium toxicity remains inexplicable, the theory of arsenic providing an alternate pathway around a critical selenium-blocked reaction still remains the most plausible explanation to date.

Protein in Diet a Protection

A second group of experiments has been concerned with the protective effect of protein against selenium. The effect of a high protein diet in protecting against selenium poisoning is still recognized, but the protective part of the protein is unknown. Experiments with linseed meal, and flax seed separations, have yielded non-conclusive data. A recently completed experiment involving methionine (one of the building blocks of protein) and vitamin E has shown that neither methionine nor methionine plus vitamin E protects against the toxicity. If selenium were replacing the sulfur of methionine, and thereby stopping certain body processes, methionine should overcome this difficulty unless the involved enzymes were inactivated. The solution of this problem remains for future research. Nitrogen balance experiments show that selenium does not interfere in protein absorption from the intestine.

Radioisotope Tracer Used to Identify Selenium Compounds

As another phase of this work, a series of selenium-containing compounds was tested for toxicity on a liver enzyme system. Variations in the toxicity of these selenium compounds, as well as of the elemental forms in which selenium occurs, were noted. This emphasizes the importance of plant work and the value of tracing the metabolic pathways of each selenium compound found to be involved.

To identify the selenium compounds that occur in plants, radio-active selenium is being used. This work is being carried out in the laboratory and at the Reed Ranch in Stanley county. The use of the radio-active isotope will be of great aid as a tracer in identifying the compounds.

Selenium Excreted by Lungs

A fourth group of experiments has been designed to collect and identify the volatile selenium compound excreted by the lungs of the selenized animal. It has been found that approximately 30 percent of an injected dose of sodium selenite is excreted by the lungs of the rat within 24 hours. The exact chemical nature of these volatile compounds is not known, but they may be very important since animals that receive selenium over a period of 14 to 16 months appear to develop lung tumors. This experiment is being repeated in order to determine whether selenium produces lung cancer.

Other experiments relative to the selenium problem have established the nature of the compounds formed when glutathione reacts with selenious acid; the need for rapid but accurate methods of selenium analysis; and the involvement of the endocrine system in selenosis. The study concerning the effect of the arsenic fed to the range cattle at Reed Ranch for the purpose of counteracting selenium poisoning is now in the sixth year with no apparent harm to the animals from feeding arsenic. (Project 19. Leaders: A. L. Moxon, H. L. Klug, E. I. Whitehead, D. F. Petersen, J. P. Baker, R. R. Johnson, Station Chemistry; C. P. Wilder, An. Husb. Dept.)

Notes TAKEN IN THE FIELD

AGRONOMY FIELD DAY

Nitrogen Key to Crop Production

One crop of corn runs your soil down 100 pounds of nitrogen per acre a year, Dr. Leo Puhr, agronomist, told farmers at the Agronomy Field Day. Barley, wheat, or oats lose 50 pounds of nitrogen from the soil per year, and sorghum, as much as 110 or 115 pounds.

Nine years of tillage experiments show that when straw residue was plowed under, only 200 pounds of nitrogen were lost per acre in nine years. When the straw was not returned to the soil, 540 pounds were lost in the nine years.

The highest yielding oat plot in the fertility experiments was the one in which the organic matter was returned. This gives the most efficient use of fertilizer, Puhr said.

Grasses have been used in rotations to see what they will do in building up soil fertility. Grasses do increase yield of crops, but don't store up nitrogen like the legumes do.

A crop of sweet clover can balance a corn crop in the amount of nitrogen it returns to the soil. Sweet clover returns 100 pounds of nitrogen a year per acre. In a rotation of sweet clover, corn, wheat, the fertility of the soil can be maintained by plowing under sweet clover every three years.

All the Small Grains Looked Good

Of the spring wheats, the farthest along on the experimental plots were Rushmore, a South Dakota release, and Lee, a new introduction released cooperatively by the USDA and Minnesota, which is now being increased for South Dakota use.

Nugget, a durum wheat from the North Dakota Experiment Station is being increased for South Dakota. It is the earliest durum wheat so far, heading right along with the spring wheats. Its milling quality is extremely high.

Brunker is still the earliest oats on the plot. It was headed out for the Field Day and had no bad oat rust, according to V. A. Dirks, agronomist.

James Hulless oats, a recent release from the Station, was of particular interest to the farmers. It is used for feed, is mid-early, stiff-strawed and has resistance to stem rust, leaf rust and smut. Dr. J. E. Grafius and V. A. Dirks, who developed the oat, said that it has been cut with a moisture content of 12-13 percent and stored in bins eight feet deep without spoilage here at the Station.

Alfalfa Selections Look Promising

Some are range-type alfalfas and others hay types. According to Dr. M. W. Adams, agronomist, these selections are to grow with bromegrass or intermediate wheatgrass and to be used for pasture. Plant breeders are trying for a type that will stay in the pasture and be able to stand constant grazing and the hard usage it will get.

It may be that the characters which these selections have will be used, and not the varieties themselves.

50 New Chemicals Screened

Screening trials were conducted in the greenhouse and the most promising of the new chemicals were then tried out in the field on crops and weeds this spring under the direction of Dr. Lyle Derscheid.

Long, 560-foot strips of oats, flax, canning peas, sugar beets, soybeans, corn and tame sunflower, plus a natural infestation of weeds, were divided into 8-foot sections. Each section was sprayed with a different chemical across all the crops so that a complete test could be made of all chemicals on all crops. For row crops which had to be cultivated, a band of weeds was left along a border in front of the crops.

Thirty-five pre-emergence and 35 post-emergence treatments were given. More than one rate of chemicals was used. These new chemicals are not yet on the market. Further testing will be necessary before recommendations can be made.

Tests were made with 2,4-D to find the most susceptible stages of growth for various crops (when the spray may harm the crop).

For small grains, the crop is very susceptible before the fifth-leaf stage. Count the leaves, before spraying—even the dead leaves. The leaf is a definite stage of growth and a better measure of when to spray than the height of the plant. Crops are also susceptible in the "boot to fully headed" stage.

Corn is susceptible at the pre-silking stage; sorghum, at the sixth leaf and twelfth-leaf and at pollination time.

Grasses and Legumes Stressed at Field Day This Year

Among the bromegrass plots shown this year, the most productive for the eastern part of the state for both hay and pasture was Homesteader, a South Dakota release developed by Dr. J. G. Ross, plant breeder.

Farmers wanted to know how much to plant and how to seed it. When planted with alfalfa, recommendations were made to use about 4 pounds of alfalfa and from 6 to 7 pounds of bromegrass. It should be seeded not more than an inch deep. That at the Experiment Station was seeded from one-half to three quarters of an inch deep. It can be seeded in the fall, but it is hazardous in a dry fall. When seeded alone, use about 10 pounds of bromegrass seed per acre.

One farmer said that he used a drill with an agitator to seed. Dr. Ross used an onion seeder.

By applying 100 pounds of ammonium nitrate, the seed yield of Homesteader was increased to 809 pounds as compared to a yield of 209 pounds without fertilizer. Hay yields of Homesteader were 2.43 tons per acre with fertilizer, as compared to 0.71 tons per acre without fertilizer.